

Fé, 15; Bloomfield, 10.3. *New York*.—Utica, 14; Arcade (1), 11.8; Turin, 11.7; Constableville, 11. *North Carolina*.—Asheville, Bakersville, Linville, Mount Airy, and Oak Ridge, trace.

*North Dakota*.—Saint Thomas, 61; Saint Johns, 29; Napoleon, 17.6; Gallatin, 14; Grand Forks, 13.8; Grand Rapids, 11.3; Fort Pembina, 11.2; Milton, 10. *Ohio*.—Montpelier, 3. *Oregon*.—Leland, 17. *Pennsylvania*.—Blue Knob, 3.5. *Rhode Island*.—Kingston (1 and 2), trace. *South Dakota*.—Webster, 18.5; Parker and Sioux Falls, 12; Yankton, 10.4; Aberdeen and Tyndall, 10. *Tennessee*.—Greeneville, McMinnville, and Rugby, trace. *Texas*.—Hartley, 0.5. *Utah*.—Park City, 49; Nephi, 33.5; Ogden, 32; Grouse Creek, 31; Provo City, 29; Levan, 22.5; Salt Lake City, 21; Blue Creek and Kelton, 20; Snowville and Terrace, 17; Losee and Parowan, 15; Cisco, 14; Richfield, 12; Mount Carmel, 10.7; Fort Du Chesne, 10.6. *Vermont*.—Strafford, 7. *Washington*.—Spokane, 22.2; Chelan, 14.5; Waterville, 11.5. *West Virginia*.—Grafton and Kingwood, 1. *Wisconsin*.—Baraboo, 17.5; Bayfield, 14.1; Florence, 10.5. *Wyoming*.—Evanston, 34; Fort Yellowstone, 24.7; Camp Pilot Butte and Casper, 10.

#### DEPTH OF SNOW ON GROUND ON 15TH AND AT THE CLOSE OF THE MONTH.

Chart VI shows the depth of snow on the ground at the close of the month, as reported by regular and voluntary observers of the Weather Bureau.

On the 15th a depth of more than 10 was reported over eastern North Dakota, in parts of Upper Michigan, in the mountains of Colorado and New Mexico, and in an area extending from northeastern Nevada over southwestern Idaho. The greatest depth in New England was 5 to 6 in central Maine and northern New Hampshire; 3 to 5 was reported in east-central New York; no snow was reported in southern New England, southeastern New York, Pennsylvania, and the Ohio and upper Mississippi valleys; 2 to 10 was noted in northern lower Michigan; 3 to 15 in Upper Michigan; trace to 8 in upper Wisconsin; 2 in central Minnesota; 5 to 12 in eastern North Dakota; trace to 5 in Nebraska; trace to 1 in Kansas; 10 to over 20 in the mountains of Colorado and New Mexico; 4 to 6 in northeastern Arizona; 2 to 4 in Utah; 8 to 18 in southern Idaho; 2 to 13 in Nevada; 3 to 18 in northeastern California; and 3.2 at Baker City, Oregon.

At the close of the month 1 to 2 was reported in northern New England and northeastern and western New York; 0.5 in the mountains of Pennsylvania; trace to 2 in Lower Michigan; 1 to 6 in Upper Michigan; 1 to 5 in northern Wisconsin;

3 to 12 in Minnesota and eastern North Dakota; trace to 2 in northern Iowa; 3 to 14 in eastern South Dakota; trace to 5 in Nebraska and eastern and western Kansas; 20 to 30 in the mountains of Colorado and northern New Mexico; 3 to 5 in northeastern Arizona and central and west-central New Mexico; 2 to 14 in Utah; 20 to 30 in Idaho; 4 to 50 in Nevada; 1 to 45 in northeastern California; 15 at Baker City, Oregon; and 4 to 6 in central and eastern Washington.

#### HAIL.

Description of the more severe hailstorms of the month is given under "Local storms." Hail was reported as follows: 1st, Washington. 2d, Oregon, Utah, and Washington. 3d, Nebraska. 4th, Kentucky and Utah. 5th, Indiana, Missouri, Oregon, and Washington. 6th, Illinois, Missouri, and Ohio. 8th, Oregon, Utah, Washington, and Wisconsin. 9th, California, Utah, and Wyoming. 12th, Arizona and New Mexico. 15th, Maine, Massachusetts, and Pennsylvania. 16th, Delaware. 18th, Alabama. 19th, Arizona and New York. 21st, Indian Territory, Iowa, Nebraska, Washington, and Wisconsin. 22d, Iowa, Washington, and Wisconsin. 23d, Oregon and Texas. 24th, Massachusetts. 27th, California and Washington. 28th, Arkansas and Washington. 29th, California, Georgia, Maryland, Missouri, New Jersey, New York, North Carolina, Oregon, Virginia, and Washington. 30th, Arizona and California. 31st, California, Kansas, Missouri, New York, Ohio, Oklahoma Territory, and Texas.

#### SLEET.

Description of the more severe sleet storms of the month is given under "Local storms." Sleet was reported as follows: 2d, Nevada and Utah. 3d, Minnesota. 4th, Michigan, Minnesota, New York, Ohio, South Dakota, and Utah. 5th, Kansas, Missouri, and New York. 6th, Illinois, Indiana, Kansas, Michigan, Missouri, New York, and Ohio. 7th, Ohio and Pennsylvania. 8th, California and Utah. 9th, Nevada and Utah. 12th, Arizona. 13th, Nebraska and New York. 14th, Nebraska and South Dakota. 15th, Connecticut, Massachusetts, Nevada, New York, Pennsylvania, and Vermont. 16th, Maine, Massachusetts, Nevada, and Pennsylvania. 18th, Alabama, Georgia, and South Carolina. 19th, Georgia and South Carolina. 21st, Iowa, Utah, and Washington. 22d, Minnesota, Texas, and Utah. 23d, California. 25th, Iowa and Missouri. 27th, Oregon. 28th, Iowa and Nebraska. 29th, Connecticut, Maine, New Jersey, Ohio, and Washington. 30th, California, Indiana, New Mexico, Ohio, and Washington. 31st, Kansas, Michigan, Missouri, Ohio, Pennsylvania, and Texas.

#### WINDS.

The prevailing winds in December, 1891, are shown on Chart II by arrows flying with the wind. In New England, the middle Atlantic states, and on the northeast slope of the Rocky Mountains southwest to northwest winds were most frequently noted; in the south Atlantic and east Gulf states and over the Florida Peninsula they were generally from northeast to southeast; in the west Gulf states, the lower Rio Grande valley, the Ohio Valley and Tennessee, and on the north Pacific coast, from east to south; in the Lake region and over the northern plateau region, from southeast to southwest; in the extreme northwest and on the south Pacific coast, from west to north; in the upper Mississippi valley and on the southeast slope of the Rocky Mountains, from south to southwest; in the Missouri Valley, on the middle-eastern slope of the Rocky Mountains, and over the middle plateau region, from south to northwest; over the southern plateau region, from north to southeast; and on the middle Pacific coast, variable.

#### HIGH WINDS.

[In miles per hour.]

Wind velocities of 50 miles, or more, per hour were reported

at regular stations of the Weather Bureau as follows: 1st, 60, w., at Tatoosh Island, Wash.; 57, se., at Chicago, Ill. 3d, 52, s., at Cairo, Ill.; 52, e., at Tatoosh Island, Wash. 4th, 63, se., at Woods Holl, Mass.; 62, sw., at Buffalo, N. Y.; 60, w., at Block Island, R. I.; 54, se., at Harrisburg, Pa.; 54, s., at Chicago, Ill.; 51, sw., at Grand Haven, Mich. 5th, 58, se., at Woods Holl, Mass.; 54, sw., at Buffalo, N. Y.; 54, sw., at Lexington, Ky. 6th, 52, s., at Fort Canby, Wash. 7th, 98, s., at Fort Canby, Wash.; 60, s., at Tatoosh Island, Wash.; 52, sw., at Fort Assinaboine, Mont. 8th, 53, sw., at Chicago, Ill.; 51, sw., at Fort Assinaboine, Mont. 9th, 56, w., at Cheyenne, Wyo.; 52, sw., at Winnemucca, Nev.; 51, sw., at Woods Holl, Mass. 11th, 50, s., at Tatoosh Island, Wash.; 50, n., at Keeler, Cal. 12th, 60, s., at Fort Canby, Wash.; 50, sw., at Buffalo, N. Y. 14th, 60, n., at Pueblo, Colo.; 52, e., at Tatoosh Island, Wash. 16th, 59, nw., at Woods Holl, Mass.; 52, se., at Fort Canby, Wash.; 50, s., at Tatoosh Island, Wash. 17th, 51, nw., at Woods Holl, Mass. 20th, 62, w., at Tatoosh Island, Wash. 22d, 60, w., at Tatoosh Island, Wash.; 52, w., at Fort Canby, Wash. 23d, 56, w., at Tatoosh Island, Wash. 25th, 66, se., at Fort Canby, Wash.; 51, sw., at Chicago, Ill.

26th, 88, s., at Fort Canby, Wash.; 66, sw., at Buffalo, N. Y.; 58, nw., at Cheyenne, Wyo.; 52, sw., at Tatoosh Island, Wash. 27th, 60, nw., at Fort Assinaboine, Mont.; 60, se., at Fort McKinney, Wyo.; 60, sw., at Winnemucca, Nev.; 50, sw., at Lander, Wyo. 28th, 60, e., at Tatoosh Island, Wash.; 58, w., at Fort Canby, Wash.; 56, sw., at Chicago, Ill. 29th, 85, w., at Fort Canby, Wash.; 66, e., at Tatoosh Island, Wash.; 60, w., at Fort McKinney, Wyo.; 50, sw., at Chicago, Ill. 30th, 56, nw., at Hatteras, N. C.; 54, nw., at Woods Holl, Mass.; 53, nw., at New York, N. Y.; 52, s., at New London, Conn.; 52, s., at Boston, Mass. 31st, 72, se., at Fort Canby, Wash.; 55, nw., at Woods Holl, Mass.

## LOCAL STORMS.

**1st.**—At Tatoosh Island, Wash., high southwest veering to west winds prevailed, with rain at intervals, and a heavy hailstorm of 2 minutes duration at 1.30 p. m. A second hailstorm, lasting 4 minutes, occurred 8.15 p. m. A heavy thunderstorm, with high wind, occurred at Levan, Utah.

**3d-4th.**—High wind and heavy snow prevailed over North Dakota and northwest Minnesota, and drifted snow interrupted railway traffic.

**3d.**—At Meridian, Miss., a thunder, wind, and rain storm began 1.15 p. m. and ended 10.10 p. m. The wind reached a velocity of 42 miles per hour from the southeast at 2 p. m., with an extreme velocity of 58 miles per hour, causing damage to roofs, trees, etc. High wind was general throughout Louisiana. At New Orleans a velocity of 36 miles per hour from the southwest was recorded. High wind damaged a railway bridge at Alexandria, La. At Saint Louis, Mo., heavy rain fell at intervals, and a southwest gale began at 9 p. m., and continued during the night.

**4th.**—High south to east winds, attaining a velocity of 30 miles per hour, prevailed at Boston, Mass. Destructive winds were reported in Vermont. Heavy gales prevailed over southern New England and Long Island Sound. Telegraph poles and trees were prostrated in the upper part of New York City. On the Hudson River a number of brick barges were capsized off Croton Point by heavy wind, and 20 men were reported drowned. At Albany, N. Y., a heavy wind and rain storm in the evening damaged trees, etc. At New Lisbon, N. Y., buildings were unroofed and trees blown down. At Malone, N. Y., a wind velocity of 65 miles per hour from the south was reported, and much damage was caused to buildings, the estimated loss being \$3,500. At Buffalo, N. Y., the wind reached a velocity of 62 miles per hour from the southwest at 10.33 p. m., and heavy rain and some sleet fell in the evening.

High southerly winds prevailed along the New Jersey coast, causing damage to seaside property and buildings in course of construction. Considerable damage was caused by high wind in the western part of New Brunswick, N. J. High winds wrecked a number of buildings in the Cumberland Valley, Pa., the estimated damage being \$20,000 to \$30,000. The storm struck Harrisburg, Pa., at 11.45 a. m., and the wind reached a velocity of 54 miles per hour from the southeast at that place, without causing material damage. At Middletown, Md., a violent wind and rain storm from the south began 12.35 p. m., damaging buildings, blowing down trees, and flooding small streams. Damage to property was reported at Taneytown, Md. A heavy squall from the southwest, lasting 9 minutes, passed over Savannah, Ga., at 8.04 a. m., with wind velocity 36 miles per hour, and a temperature fall of 10°.

At Detroit, Mich., a southeast gale set in at 8.48 p. m., 3d, and continued during the 4th, with wind shifting to southwest and reaching a velocity of 42 miles per hour at 4.30 p. m. Damage was caused at points throughout the state, and a number of vessels were wrecked. At Muskegon, Mich., a large building was unroofed, involving a loss of about \$10,000, and a number of other buildings were injured. At Grand Haven, Mich., the wind reached a velocity of 51 miles per hour from the southwest at night, and rain was followed by sleet and

snow; the draw of the Spring Lake bridge was blown down and 3 cribs at the end of the south pier were moved from their position, involving a loss of several thousand dollars. A southwest gale, with snow, prevailed at Saint Paul, Minn., and the walls of a building recently burned were blown down, killing 8 men. Damage was caused to roofs at Sioux City, Iowa, by violent gusts of wind which attended a southwest gale in the early morning.

**6th.**—A heavy snowstorm prevailed over northern Iowa, northern Illinois, and southern Wisconsin, interrupting traffic and delaying railway trains.

**7th.**—At Kitty Hawk, N. C., the wind shifted to northwest at 6.50 p. m., and attained a velocity of 48 miles per hour. A whirlwind was reported at Kill Devil Hill Life Saving Station, which carried away several outhouses. An unusually heavy and destructive windstorm prevailed along the north Pacific coast. At Tatoosh Island, Wash., the wind reached a velocity of 60 miles per hour from the south, and heavy rain fell in the early morning. The storm was reported the severest ever experienced at Port Angeles, Wash.; a large number of trees were uprooted; great damage was caused to buildings, about 40 being crushed in; many persons were injured; and the Government telegraph line to Tatoosh Island was demolished. At Olympia, Wash., high south wind prevailed, with rain in the afternoon, and passenger steamers remained in port. At Fort Canby, Wash., high south winds, reaching a velocity of 98 miles per hour, with heavy rain, continued during the day, causing damage to buildings.

At Walla Walla, Wash., a storm from the south began 11.20 a. m. and ended 9.50 p. m., with a maximum velocity of 42 miles per hour, and an extreme velocity of 55 miles per hour at 6.53 p. m.; a large barn was unroofed, trees were blown down, and other damage caused. At Portland, Oregon, brisk to high winds prevailed, reaching a velocity of 44 miles per hour, and from noon to 6 p. m. the wind velocity was 32 miles per hour; the roof of the instrument shelter at the Weather Bureau station was blown off, trees were prostrated, and other damage of a minor character was reported. At Astoria, Oregon, a southwest gale, with heavy rain, continued from 7 a. m. until 6 p. m., causing considerable damage in and about the city; houses were unroofed and overturned; vessels in the harbor dragged their anchors; and telegraph lines were prostrated. At Eureka, Cal., a heavy gale began the afternoon of the 7th, with rain at intervals from 3.10 to 7.30 p. m., and continued during the 8th; all vessels remained in port.

**8th.**—At Carson City, Nev., a southwest gale, with light snow, prevailed, the wind reaching a velocity of 58 miles per hour; from 8 p. m., 7th, to 8 a. m., 8th, the temperature rose 19° 5. At Port Huron, Mich., a windstorm prevailed during the afternoon and evening, a velocity of 47 miles per hour being reached at 3 p. m.

**9th.**—Heavy west winds, reaching a velocity of 56 miles per hour, damaged buildings at Cheyenne, Wyo.

**11th.**—At Los Angeles, Cal., fresh to high northerly winds prevailed in the early morning, reaching a velocity of 26 miles per hour from the northwest at 4.15 a. m. During the morning the wind increased in force from the north, with a maximum velocity of 28 miles per hour at 10.25 a. m. In the San Bernardino, San Gabriel, and San Fernando valleys the storm was more severe, the wind demolishing a number of houses and causing great damage to orange groves. At Pasadena and Glendale a number of houses were blown down, and telegraph lines running east and north from Los Angeles were prostrated.

**14th.**—A heavy wind and snow storm swept over the Rocky Mountain region from central Colorado over northern New Mexico. At Pueblo, Colo., a severe "norther" began shortly after midnight and the wind velocity varied from 40 to 60 miles per hour until noon, with snow from 3 a. m. to 11 a. m.; buildings were damaged to the extent of about \$6,000. In northern New Mexico drifted snow interfered with railroad traffic.

**16th.**—A heavy gale prevailed along the New Jersey and southern New England coasts. During the evening a snow-storm set in over east-central New York.

**19th.**—At San Francisco, Cal., the pressure decreased rapidly until noon, with light rain at intervals. About 9.30 a. m. (local time) a house was demolished, and a street car was overturned by a whirl or strong gust of wind in the western part of the city; the wind velocity at the Weather Bureau office was 27 miles per hour from the west at that hour, the highest noted for the day.

**20th.**—High south to west gales prevailed on the Washington coast and in the Straits, and a general snowstorm was reported throughout southern British Columbia.

**21st.**—A wind and snow storm extended over eastern Washington. A heavy wind and rain storm set in at night over northwestern Washington. At Salt Lake City, Utah, a snowstorm, with heavy gusts of wind, which commenced the morning of the 20th ended 11.45 a. m. Severe storms occurred in South Dakota, Nebraska, and Iowa; snow falling in South Dakota; rain, sleet, and snow in Nebraska; and thunderstorms, with rain and sleet, in Iowa.

**22d.**—Heavy westerly winds continued on the coasts of northwest Washington. At Newport, Oregon, windows were reported broken by concussion during an unusually violent thunderstorm.

**23d.**—High westerly winds continued on the Washington coast. At Upper Lake, Cal., a heavy windstorm from the northwest occurred in the early morning. A severe storm prevailed over Louisiana, Mississippi, and Alabama. In northern Louisiana the rainfall measured 4.00 to 6.00. At Meridian, Miss., rain fell in the evening; the wind veered from southeast to south, with a maximum velocity of 38 miles per hour, and an extreme velocity of 60 miles at 8.26 p. m., causing damage to fences and trees. At Mobile, Ala., a windstorm began suddenly at 7.50 p. m., with light rain; the electric-light tower in Washington square was blown down.

**24th.**—At Chattanooga, Tenn., a heavy wind and rain storm occurred in the early morning; the wind reached a velocity of 36 miles per hour from the south, causing damage to roofs, trees, etc. A general and heavy snowstorm prevailed over the Dakotas. At Cheyenne, Wyo., snow began in the early morning, with high north wind.

**25th.**—A heavy snowstorm prevailed over Nebraska and western Iowa, interrupting traffic. A northwest gale, with snow, was reported at Duluth, Minn., in the evening. Snow was also reported in Oregon and Washington east of the Cascade Mountains.

**26th.**—Heavy gales occurred on the coast of Washington. Heavy snow and wind storms prevailed in eastern Oregon and northeastern California. At Eureka, Cal., a severe rainstorm set in during the evening, and rain and high winds continued at that place until the 31st. At Cheyenne, Wyo., heavy northwest winds were destructive to buildings, etc. At Buffalo, N. Y., a severe gale began 11.35 a. m.; the wind reached a velocity of 66 miles per hour at 1.56 p. m.; rain fell in the morning, and snow flurries occurred in the afternoon.

**27th.**—At Salt Lake City, Utah, the wind increased in force in the evening, with sleet, changing to heavy snow; snow fell throughout the night, delaying trains, etc. At Lander, Wyo., the wind shifted to southwest in the morning and reached a velocity of 50 miles per hour. At Fort Assinaboine, Mont., high southwest wind and snow began about noon. The lowest barometer on record at that station, 29.04 (reduced), was noted at the 8 a. m. observation.

**29th.**—Severe storms prevailed on the north Pacific coast, over parts of the middle Rocky Mountain region, in Tennessee, and along the Atlantic coast from the Carolinas northward. At Olympia, Wash., rain, with high southwest winds, continued throughout the day. At Aberdeen, Wash., the wind reached a velocity of 40 miles per hour from the southwest in the afternoon, causing unusually high tide. At Walla Walla, Wash., the wind reached a velocity of 45 miles per hour from the southwest, and an extreme velocity of 60 miles. High wind, with light rain, prevailed at Roseburgh, Oregon. At Astoria, Oregon, an unusually violent southwest gale, with light rain, began the night of the 28th and continued during the early morning of the 29th, wrecking buildings, uprooting trees, etc. The pressure fell from 29.74 at 4.40 p. m., 28th, to 28.92 at 4.30 a. m., 29th.

At McMinnville, Oregon, a furious gale during the early morning caused considerable damage of a minor character. At Salinas, Cal., the rainfall during the 28th and 29th was exceptionally heavy. Heavy drifting snow interrupted railroad traffic in the mountains of Colorado and northern New Mexico. During a heavy thunderstorm at Nunnely, Tenn., the wind, reached a velocity of 40 miles per hour from the south. At Raleigh, N. C., a thunder and rain storm advanced from the southwest about 6.40 p. m., with heavy thunder and lightning for 20 minutes. Lightning struck a barn on the North Carolina Experiment Station farm, one mile west of Raleigh; the barn and adjoining stables were burned and 2 mules were killed. Heavy rain and thunder storms occurred in eastern Virginia in the evening, and high winds prevailed along the New Jersey and New England coasts.

**30th.**—A heavy wind and rain storm prevailed over New England and along the Atlantic coast to Hatteras, N. C., causing considerable damage. A severe wind and snow storm occurred over northern Utah.

**31st.**—At Abilene, Tex., a thunderstorm advanced rapidly from the west at 6.30 p. m., with rain, hail, and high wind reaching a velocity of 48 miles per hour. Rain and hail continued 10 minutes, the hailstones being small, and the temperature fell 20° during the storm. At Gallinas, Tex., a heavy black cloud and frequent flashes of lightning were observed in the west and northwest about 8 p. m. As the storm approached brisk south winds were succeeded by strong gusts from the northwest, with light rolling thunder. At Gainesville, Tex., buildings were damaged by high winds. A severe storm was reported at Marksville, La., in the evening. A thunderstorm occurred at Atchison, Kans. High winds prevailed along the New England coast. Heavy southerly winds were reported on the Washington coast.

## INLAND NAVIGATION.

### ICE IN RIVERS AND HARBORS.

The Penobscot River was reported closed by ice at Bangor, Me., on the 18th.

The Connecticut River was frozen over for the first time this season at Middletown, Conn., on the 18th.

Large quantities of ice were reported in the Hudson River at Albany, N. Y., on the 17th, and on the 20th ice 2 to 3 inches in thickness was reported between Albany and Hudson, N. Y.

Floating ice was reported in the Detroit River on the 18th, 19th, 21st, and 30th.

The Grand River was closed by ice at Lansing, Mich., on the 7th, open on the 14th, closed on the 18th, and open on the 22d.

A rapid rise in the Black River caused the ice to break up at Black River Falls, Wis.; timber and piling of a railroad bridge in course of construction were carried away and other damage caused.

**Mississippi River.**—On the 5th the ice on Lake Pepin was 8 inches in thickness, and teams were crossing. At Red Wing, Minn., the ice broke up during the early morning of the 14th;